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ABSTRACT

Modeling outcomes of school, hospital, or country performance as a consequence of initial conditions and assessing the entity's actual performance relative to what the model predicts (i.e., constructing a regression residual) is a natural way to measure performance. The usefulness of residual-based measures of performance depends on their robustness with respect to alternative statistical estimation procedures and model specifications. This paper assesses robustness for an analysis of country-level performance with respect to male and female adult mortality rates controlling for the country's income and education levels or for income alone. The data, which come from several different sources, including records from the World Bank, consist of 505 observations from 77 countries. Performance assessments of the more desirable models for each indicator are highly correlated, giving confidence in the robustness of the results. Country performance with respect to female mortality often differs substantially from that with respect to male mortality, however, pointing to the importance of separate rankings. While the paper concludes that residual-based performance measures work well in the context examined, the analysis also suggests that robustness may be context specific. Methods used in this paper to assess robustness can be extended to other contexts. (Contains 9 tables, 4 figures, and 13 references.) (Author/SLD)

DRAFT

Regression Residuals as Performance Measures:
An Assessment of Robustness in the Context of Country-Level Data

by

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ABSTRACT

Obvious policy relevance attaches to the task of assessing the performance of schools, hospitals or countries in achieving desirable outcomes. Simply ranking outcome levels will be inappropriate if different schools or countries, say, start from different places (e.g. entering test scores of students or income levels of countries). Modeling outcomes as a consequence of initial conditions and assessing a school or country's actual performance relative to what the model predicts (i.e. constructing a regression residual) is a natural way to measure performance: Performance is good when actuals are better than predicted and vice versa. Assessing performance does not, of course, explain why performance varies across schools or countries. But it does provide the analyst with something to be explained by potential determinants, some of which could be influenced by policy and some of which that could not.

The usefulness of residual-based measures of performance depends on their robustness with respect to alternative statistical estimation procedures and model specifications. This paper assesses robustness for an analysis of country-level performance with respect to male and female adult mortality rates controlling for the country's income and education levels or for income level alone. Performance assessments of the more desirable models for each indicator are highly correlated -- giving confidence in the robustness of the results. Country performance with respect to female mortality often differs substantially from that with respect to male mortality, however, pointing to the importance of separate rankings.

While the paper concludes that residual-based performance measures work well in the context examined, the analysis also suggests that robustness may be context-specific. Methods used in this paper to assess robustness can be extended to other contexts.

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Countries vary enormously in their levels of mortality. Differences in education and income levels account for part of this variation at any point in time; that said, even after controlling for education and income levels some countries do much better than others. Measuring country "performance," after controlling for education and income or income alone, provides a potential indicator for judging the effects of policies that could improve health, whether those policies concern education or are within the health sector. The reliability and validity of residual-based country performance measures have been concerns incompletely addressed in the literature to date. It is the purpose of this paper to examine the properties of regression residuals used to measure country health performance and, using those measures, to construct a "league table" that ranks countries. The analysis is undertaken in the context of assessing the robustness of our estimates of the effects of education and income levels on health.

The paper begins by reviewing ways that residuals have been used to assess performance in education, then discusses the data and modeling methods that underly our assessment of robustness of ranking orders that are based on residuals. We model country health performance on female and male adult mortality[1] as a function of income per capita,[2] education level,[3] and time (as a proxy for technical progress generally defined). Our data are for 77 countries over the period 1960-90 at 5-year intervals. The paper next generates

[1] The adult mortality rate (what demographers call 45q15) is defined as the probability of dying in the 45 years following the 15th birthday assuming maintenance of current sex- and country-specific mortality rates by age (World Bank, 1993, p. x). As is typical, we express this probability per thousand.
[2] The income numbers are in 1985 international dollars adjusted for purchasing power parity (Summers and Heston, 1991; Heston and Summers, 1996).
[3] The average years of education in the female/male population aged 15 and over are used as the education level measure (Barro and Lee, 1996)

rankings based on the residuals resulting from using different estimation procedures: Ordinary Least Squares (OLS) regression, Generalized Least Squares (GLS) cross-sectional time-series regression (with random effects), and hierarchical linear modeling (HLM, Bryk & Raudenbush, 1992) for each indicator. Robustness of rankings with respect to these estimating procedures is then assessed. Robustness is also assessed with respect to alternative specifications of the underlying model, i.e. with respect to inclusion of different variables and various transformations of variables. A concluding section discusses the results.

Perspectives

Residuals have been used in the education field to identify schools that are effective in fostering their students' educational outcomes at least since early 1980 (e.g. Abalos, Jolly, & Johnson, 1985; Kreft & De Leeuw, 1991). The use of residuals to construct performance indicators is, however, not limited to issues on education, residuals have been used in issues related to economics, public health, management, etc. in recent years (e.g. Abalos, Jolly, & Johnson, 1985; Behrman, 1996; Jamison, Wang, Hill, & Londoño, 1996; Kreft & De Leeuw, 1991; Tracy & Waldfogel, 1997; Wang & Jamison, 1997; Wang, Jamison, Bos, Preker, & Peabody, 1998). On the other hand, despite of the wide usage, there remain some substantive and methodological concerns about identifying, ranking, and rewarding schools or other comparison units based on regression residuals. The substantive issues concern interpretation of the results. Based on the residuals, schools that are low in input variables but perform near the regression line would be considered good performers that meet expectations, even though their actual performance is far below other schools and the average. At the same time, some schools would be considered poor performers for deviating from the regression line given their high input values, despite the above average performance. If the concern of the analysis is absolute performance then actual performance (i.e. residuals from the mean of the dependent variable) is appropriate. The use of residuals from regression-based predictions is appropriate when the concern is relative performance.

Two of the methodological problems with ranking schools based on regression residuals are that the ranking of schools may differ as a result of changes in estimation procedures and that the ranking across grades and subject areas may be unstable. Empirically, however, the results tend to be quite consistent when similar approaches (those based on regression analysis) have been used to produce the residual ranking (e.g. Abalos, Jolly, & Johnson, 1985; Kreft & De Leeuw, 1991; Webster & Olson, 1984). The other potential methodological problem is inaccuracy due to ignorance of the multilevel structure of school systems. Students are not sampled individually; instead, they are usually sampled once the particular schools they attend are sampled. These students are not independent subjects and the individual error terms in the same subgroup are correlated. The error terms contain random measurement errors and the unmeasured errors resulted from not including all related predictors in the analysis. These unmeasured errors are usually systematic; students within the same classroom (school) share more characteristics than with students belong to another group. The standard errors are usually smaller if the nesting nature of the data is ignored, which causes non-significant predictors to be significant.

Realizing the danger of aggregating information across different health indicators, we ran separate analyses for each of the selected health indicators. There are four main reasons for that. First, education and income effects differ for different health outcomes, and estimating their effects separately is therefore important. Second, there is the compatibility issue: different health measures are based on different populations and provide different information. A country that has good performance on decreasing its male adult mortality rate does not automatically also have great performance on decreasing its female adult mortality rate. Gender bias could be a serious problem for that country. The third reason is that the improvement of different health measures requires changes of specific health policies. The fourth reason is that by making the health performance trend information specific to the country and to the health measure, it will be easier for policymakers to identify the consequences of previous health policies. Consequently, individual country health performance measures could be used by the policymakers and health administrators, if they chose to do so, in their decision making that is related to the specific health issue.

Data and Methodology

Data. The data used here are compiled from several different sources. The health outcome measures (adult mortality rate) are based on the updated World Bank demographic files. The per capita income figures are from the Penn World Table, Version 5.6 (Summers & Heston, 1991; Heston & Summers, 1996), and we use Barro and Lee's (1996) education stock data for education level measurement. The data period covers from 1960 to 1990, with time points separated by 5 years. The focus of the analysis is on the low- and middle-income developing countries and countries from Central and Eastern Europe or the former Soviet Union; no high-income countries are included. There are 77 countries with a total of 505 observations in the dataset (not all countries have information on all 7 time points). The countries included in the analysis are listed in Table 1 and the descriptive information is reported in Table 2.

From 1960 to 1990, the overall level of income per capita and average years of education in the female and male population increased dramatically while mortality declined. Both female and male adult mortality decreased by about a third; income per capita level almost doubled, from $1415 to $2543; and education level increased by about two-thirds. The average years of education in the female population, across all countries, were 2.2 years in 1960 and 4 years in 1990; and for the male population they were 3 years in 1960 and 5 years of education in 1990.

Methodology. Three regression procedures were used to derive the residuals that were used to rank countries on their performance on adult male and female mortality rates. These procedures are: OLS regression, GLS regression in the context of STATA's (1995) cross-sectional time-series regression, and HLM using the maximum likelihood function. One of the standard assumptions in regression analysis is that the errors are not correlated, in other words, the error term associated with observation *i* is not associated with the error term for observation *j*. This is clearly violated in our data, with countries repeatedly observed every 5 years from 1960 to 1990. The error observed in one time point is correlated with the ones in the other time points. This correlation is called "autocorrelation."

In conventional OLS regression, country observations are treated as if they are independent units; the fact that the same country is observed multiple times across the period of 1960 to 1990 is ignored. According to Chatterjee and Price (1994), the presence of autocorrelation causes the estimates to be inefficient, since the variance is not minimized, even though the estimates are unbiased. In addition, the variance estimate and the standard errors of the regression coefficients may be seriously underestimated, which gives the false impression of accuracy and significance. These could seriously bias the regression results and consequently bias the country rank orders based on the derived residuals.

Cross-sectional time-series regression in STATA is a special form of regression designed to analyze data on *i* units (individual countries) over *t* time periods. It adjusts for the autocorrelation problem resulting from observing the same country multiple times and each observation is not independent of the others. A random-effect regression model is used to estimate the effects of income per capita, total years of education, and time on reducing adult mortality rates. The GLS random-effect estimator is a matrix-weighted average of the estimates from the between and within estimators. The procedure could separate the residuals into two parts: country effect and country random error for each time point.

HLM is a recently developed statistical method for analyzing multilevel data and for reducing bias in the standard errors associated with the coefficient estimates. Its estimates take into consideration the nesting nature of the data. In the case here, time periods are nested under country and the country is repeatedly measured in different time periods. Full maximum-likelihood function is used during the estimation, the derived standard errors should be free of bias that is related to the nesting nature of the data. To test how HLM results differ from OLS and GLS regression results, we had income, education, and time indicators as level-1 predicators with their effects constant across countries. The intercept (mean country mortality rate) is left to vary across countries. The model is actually a special form of an HLM growth model estimating how mortality rates decline over time, controlling for income and education effects.

At the end of each run, HLM also provides a residual file containing the average coefficient estimates and unit-specific deviation from the average coefficient estimates under both Empirical Bayes (EB) and Least Squares (OL) estimates. The unit-specific intercept deviation using EB is to be used as the performance indicator for the country.

Results Concerning Alternative Estimation Procedures

This section discusses results concerning the robustness of residual-based rank orderings with respect to alternative statistical estimation procedures; it begins by reporting the regression results, then it examines properties of the residuals.

Regression Results. The regression results for female and male adult mortality rates are reported in Table 3. Countries' income per capita, average years of education for the female or male population between 15 and 60, and 6 time dummies (1960 is the reference group) are used to explain the variation in adult mortality rates in the past 30 years. Looking at Table 3, it is easy to notice that the coefficients of income and education on reducing mortality are the largest in OLS regression and that the estimates are similar between HLM and GLS. The time coefficients, on the other hand, were the smallest in OLS and the largest in HLM. This is a quick overview of the results.

The first and fifth columns of Table 3 have the regression results using OLS, Column 1 has the male mortality results and Column 5 has the results for female. Income per capita, education level, and time indicators together can explain 61% and 71% of the variation in male and female mortality rates, respectively. Holding the other variables constant, a 10% increase in income could reduce male and female mortality by 2.6%; one year of additional education is associated with 7% and 12% mortality reduction in male and female mortality rates respectively.

Based on the GLS regression results on male mortality, holding the other variables constant, a 10% income increase results in a 1.4% reduction in male mortality; one additional year of education reduces mortality by 4%. And holding income and education constant, compared to the mortality rate of 1960, male mortality is 5% lower in 1965, and 21% lower in 1990. The corresponding reductions in female mortality due to the various factors are: a 10% income increase, 1.6%; one additional year of education, 9%; technical progress, 1960-1965, 6%; and technical progress, 1960-1990, 23%. Income elasticity is weaker for males than for females; education and technical progress are more effective in reducing female mortality than male mortality. The R-square values that are equivalent to the ones in OLS regression are the overall R-squares in GLS. They are 57% and 71% for male and female mortality respectively, lower than the R-square values in OLS.

Before running the compatible model in HLM framework, we ran the unrestricted model to see how much variation in the outcome variables lies within and between countries and to look at the reliability of each country's sample mean as an estimate of its true population mean. The reliability for the mean is 0.97 for both female and male mortality rates. The intraclass correlation (ρ), which measures the proportion of the variance in the outcome that is between countries, is 0.83 for both the female and male adult mortality rates. In other words, 83% of the variance found in the female (or male) mortality rate is between countries. The high intraclass correlations justify the rationale for doing HLM analysis instead of conventional regression analysis. The large Chi-square values and small p-values associated with the variance component related to mean difference across countries suggest that there are differences between countries in their mean health performance levels. This finding strongly reinforces the need to have the intercept as a random variable.

The final HLM results are reported in the fourth and seventh columns of Table 3. For male mortality, HLM has the identical education effect as found in GLS; the other estimates are very close to the ones in GLS. Based on HLM estimation, technical progress effects in 1965 and 1980 are 6% and 14%, compared to 5% and 12% in GLS regression. The income elasticity is -0.13 instead of -0.14 in GLS. For female mortality, the results are quite different from the results in OLS and close to the GLS regression. Education effect in both HLM and GLS is -0.09, reduced form -0.12 from the OLS regression. The income elasticity is -0.16, compared to -0.26 in OLS and -0.16 in GLS. The coefficients associated with time indicators in HLM are bigger, at the same time, than OLS results. Relative to the mortality in 1960, it is 6%, 9%, 13%, 15%, 21%, and 24% lower in 1965, 1970, 1975, 1980, 1985, and 1990, respectively, compared to 1960.

HLM also provides estimates of the variances of the random effect, the intercept in our model. Looking at the p-values reported under Variance Component in Table 3, we can see that significant differences exist among the means of country health outcomes for both female and male, even after controlling for the income, education and technical progress effects. This type of finding usually leads to adding proper country predicators to the level-2 model to reduce the variance component.

In summary, looking at the coefficient estimates from OLS, GLS, and HLM runs, it is concluded that the estimates are misleadingly large in OLS regression and the estimates from GLS and HLM procedures are compatible to each other and correctly adjusted. This is the initial evaluation of the results; the next section will compare the residuals and evaluate them.

Residual Construction and Comparison.

Since we are interested in examining the statistical accuracy of using regression residuals in ranking country performance, we should compare the residual values from these different procedures and the subsequent country ranking lists. Regression residuals from OLS procedures could be easily obtained by averaging the residuals at different time points to get a residual index to represent the country. For the random-effect GLS regression, we use the country residual component, which is constant across time points and unique to the specific country, as the index value. For HLM, since the saved residual file could provide the average regression coefficients and unit-specific deviations from the averages, we use the country intercept deviation value, using EB, to rank countries in their health performance.

The correlation matrix of these residual values is summarized in Table 4. GLS residuals have higher correlation with HLM residuals than OLS with HLM or GLS with OLS for both indicators. For example, for female mortality residuals, the coefficient between GLS and OLS residuals is 0.91; it is 1.00 between GLS and HLM residuals; and it is 0.90 between OLS and HLM.

The country residual values and their corresponding rankings are reported in Tables 5 and 6. Table 5 has the country ranking and residual values on female mortality and Table 6 is for male mortality. Both tables have the overall country ranking based on their average residuals across time (as in OLS regression), intercept deviations (from HLM) or fixed country residuals (from GLS regression). The residual values and the rankings using GLS and HLM are very similar; the correlation coefficients between these two sets of residual values are 1.00 for both indicators. And the maximum ranking order difference between these two procedures is 4. Bahrain ranked 45th using GLS residuals and number 41 in HLM. The ranking orders based on different regression procedures are also plotted in Figures 1 and 2. Looking at these two figures, we can see that the rankings based on OLS are different from the orders based on GLS and HLM residuals (Panels A and C). The orders from GLS and HLM are almost identical (Panel B), the dots or most of the dots lined up on the 45-degree line in Panel B of both figures.

Results Concerning Alternative Model Specifications

This section compares regression results and ranking orders using different model specifications. We tried out various alternatives: assuming no technical progress effect on health improvement in the past 30 years; treating technical progress effect as linear (having time as a continuous variable); transforming years of education into the natural log form for data interpretation convenience; and excluding an education predicator from the model to increase the sample size in the future analysis. A GLS regression procedure is performed for each of these alternatives. GLS is preferred over HLM for the exercise here because of the almost-identical regression coefficients, almost-identical regression residuals, and the difficulty of data manipulation after the data is imported into HLM.

Regression Results

The summary of these regression results, using a GLS estimator, is reported in Table 7. There are four criteria we used in our model selection exercise. One is that the model should explain as much variance in the outcome variable as possible; in other words, a higher R-square value is preferred. The second is related to the model's goodness of fit value: we want the highest possible Chi-square value and the lowest associated p-value. Third, the variance of the residuals should be constant, at least relatively. Lastly, the model should have some theoretical support from the previous literature.

Models 1A and 1B were rejected because of low R-square and Chi-square values, in addition to being at odds with the literature. Previous literature on health improvement has documented a tremendous amount of technical progress in the past 100 years or so. Models 5A and 5B were dropped mainly because the variance of the residuals is not constant across predictors, i.e. the variance increases with the education values. Models 3A and 3B, without including education as a predicator, were acceptable and attractive considering its' power in explaining the variance and its goodness of fit. They could substitute for Model 4 if the availability of education data is limited. Statistically, one would choose Model 2 over Model 4 because Model 2 has fewer parameters to be estimated while the R-square and Chi-square values are compatible. However, our belief in the uneven technical progress effects over the past 30 years strongly led us to prefer Model 4. This belief is confirmed if one looks at the significant time coefficients and nonlinear technical progress effect in this 30-year period. Technical progress has the strongest effect between time4 (1980) and time5 (1985).

Residual Construction and Comparison

Table 8 has the country ranking orders based on residuals from Models 3 and 4, using GLS estimation procedure. The ranking differences between these two sets of residuals are also plotted in Figure 3. Male mortality rankings fall more tightly along the 45-degree line than female rankings. The correlations between the residuals are 0.90 and 0.97 for female and male mortality residuals, respectively.

Countries' Different Performance Ranking on Female and Male Mortality

Since countries don't necessarily have the same performance profile across different health indicators, we did separate analyses for each selected health indicator. As the ranking differences in Table 9 indicate, our concern was quite justified. For example, El Salvador ranked 38th among the 77 countries we analyzed on its male mortality performance, while it ranked 16th on female mortality performance. In general health performance in regard to females has been much better than for males in El Salvador, relatively to the other countries in the analysis. This profile is reversed in the Philippines, where females ranked 20 points behind the males in their performance ranking. The ranking differences using HLM are also reported in Table 9 and plotted in Figure 4. Two extreme countries on both ends are identified in Figure 4 with their corresponding rankings.

Conclusions

This study both extends the usage of regression residuals from comparing schools on their student academic achievement to the field of health and also provides improved quantitative estimates of the effects of education on a range of health outcomes. Countries' health performance over the past three decades is compared in terms of adult mortality. By investigating the consistency of country performance measures based on residuals from alternative regression models, this paper draws conclusions about the robustness of residual-based rankings with respect to alternative estimation procedures and model specifications. The main conclusions are as follows:

1. Rankings based on GLS and HLM procedures are extremely highly correlated; those based on OLS are also correlated, but less so. Statistical considerations lead to viewing OLS as less appropriate than the other two estimating techniques, so we conclude robustness to be high. The estimated magnitude of the effect of education and income on health outcomes varies little between GLS and HLM.
2. Rankings based on alternative models for the same dependent variable were highly correlated; and, for the model with results less well correlated with the others, substantive considerations led to its being considered inappropriate. In some circumstances it will be appropriate to consider a much broader range of model specifications than we have done here, but the simple models we consider suit our relatively limited dataset.
3. If the alternative models do and do not include a variable known to be a major outcome determinant, rankings can be substantially affected. In this case we examine the consequences of not including education levels as a control variable. For some purposes this might be a preferred specification if the intent is to focus on performance relative to income only. Other reasons for exclusion may be more practical: Communication of

results to policymakers may be easier and, in this case, limited availability of data on education reduces the number of countries to be assessed from 115 to 77 (we had 115 countries in our original dataset). Rankings with and without education are substantially but imperfectly correlated.

4. Rankings of countries for performance with respect to female adult mortality differed remarkably from those for males. This confirms the observation from the literature that constructing separate rankings for different dependent variables is appropriate unless the rankings have been demonstrated to be quite similar.

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Table 1.
List of Countries in the Dataset.

1	ALGERIA
2	ARGENTINA
3	BAHRAIN
4	BANGLADESH
5	BARBADOS
6	BENIN
7	BOLIVIA
8	BOTSWANA
9	BRAZIL
10	BULGARIA
11	CAMEROON
12	CENTRAL AFRICAN REP.
13	CHILE
14	CHINA
15	COLOMBIA
16	COSTA RICA
17	DOMINICAN REP.
18	ECUADOR
19	EGYPT, ARAB REP. OF
20	EL SALVADOR
21	FIJI
22	GAMBIA, THE
23	GHANA
24	GUYANA
25	HAITI
26	HONDURAS
27	HUNGARY
28	INDIA
29	INDONESIA
30	IRAN, ISLAMIC REP. OF
31	IRAQ
32	JAMAICA
33	KENYA
34	KOREA, REP. OF
35	LESOTHO
36	LIBERIA
37	MALAWI
38	MALAYSIA
39	MALI
40	MAURITIUS
41	MEXICO
42	MOZAMBIQUE
43	MYANMAR
44	NEPAL
45	NICARAGUA
46	NIGER
47	PAKISTAN
48	PANAMA
49	PAPUA NEW GUINEA
50	PARAGUAY
51	PERU
52	PHILIPPINES
53	POLAND
54	REUNION
55	ROMANIA
56	RWANDA
57	SENEGAL
58	SIERRA LEONE
59	SOUTH AFRICA
60	SRI LANKA
61	SUDAN
62	SWAZILAND
63	SYRIAN ARAB REP.
64	TANZANIA
65	THAILAND
66	TOGO
67	TRINIDAD AND TOBAGO
68	TUNISIA
69	TURKEY
70	UGANDA
71	URUGUAY
72	VENEZUELA
73	YEMEN, REP. OF
74	YUGOSLAVIA, FED. REP
75	ZAIRE
76	ZAMBIA
77	ZIMBABWE

Table 2.
Means and Standard Deviations of Mortality, Income, and Education.

	Descriptive Statistice	Adult Mortality Female	Adult Mortality Male	Income	Education Female	Education Male
Overall	Mean	272.22	341.87	2098.11	3.00	3.95
	Standard Deviation	*(130.38)*	*(135.72)*	*(1804.64)*	*(2.21)*	*(2.14)*
1960	Mean	337.43	408.73	1415.76	2.20	3.00
	Standard Deviation	*(136.25)*	*(147.31)*	*(1137.41)*	*(1.81)*	*(1.89)*
1965	Mean	310.78	380.05	1558.80	2.32	3.15
	Standard Deviation	*(129.52)*	*(139.57)*	*(1278.21)*	*(1.82)*	*(1.84)*
1970	Mean	288.96	356.75	1790.00	2.65	3.52
	Standard Deviation	*(125.93)*	*(134.95)*	*(1398.71)*	*(2.12)*	*(2.00)*
1975	Mean	268.26	337.96	2192.28	2.87	3.83
	Standard Deviation	*(123.78)*	*(128.16)*	*(1847.78)*	*(2.16)*	*(2.09)*
1980	Mean	249.53	321.22	2562.34	3.28	4.31
	Standard Deviation	*(120.21)*	*(121.63)*	*(2250.70)*	*(2.25)*	*(2.15)*
1985	Mean	231.62	301.74	2513.79	3.58	4.67
	Standard Deviation	*(117.69)*	*(117.76)*	*(2021.71)*	*(2.27)*	*(2.06)*
1990	Mean	218.22	285.89	2542.97	4.00	5.02
	Standard Deviation	*(119.41)*	*(120.12)*	*(1965.92)*	*(2.42)*	*(2.16)*

Table 3.
Coefficient Estimates of the Effects of Income Per capita, Years of Education, and Technical Progress on Adult Mortality Using Different Regression Procedures.

Coefficient Estimates	Male Adult Mortality Rate			Female Adult Mortality Rate		
	OLS	GLS	HLM	OLS	GLS	HLM
Intercept	7.98	7.09	5.87	7.80	7.09	5.61
logy5	-0.26	-0.14	-0.13	-0.26	-0.16	-0.16
	(14.28)	*(6.06)*	*(5.46)*	*(12.04)*	*(6.13)*	*(5.83)*
tyrm	-0.07	-0.04	-0.04	-0.12	-0.09	-0.09
	(9.43)	*(5.31)*	*(4.95)*	*(15.96)*	*(9.76)*	*(9.43)*
time1	-0.03	-0.05	-0.06	-0.04	-0.06	-0.06
	(0.75)	*(2.76)*	*(2.99)*	*(0.82)*	*(2.80)*	*(2.89)*
time2	-0.03	-0.09	-0.10	-0.04	-0.09	-0.09
	(0.76)	*(4.71)*	*(5.14)*	*(0.88)*	*(4.33)*	*(4.56)*
time3	-0.03	-0.11	-0.12	-0.06	-0.13	-0.13
	(0.66)	*(5.28)*	*(5.81)*	*(1.28)*	*(5.80)*	*(6.11)*
time4	-0.01	-0.12	-0.14	-0.05	-0.15	-0.15
	(0.34)	*(5.45)*	*(6.06)*	*(1.12)*	*(6.18)*	*(6.55)*
time5	-0.05	-0.17	-0.19	-0.10	-0.20	-0.21
	(1.24)	*(7.19)*	*(7.82)*	*(2.07)*	*(8.12)*	*(8.50)*
time6	-0.09	-0.21	-0.23	-0.11	-0.23	-0.24
	(1.93)	*(8.29)*	*(8.94)*	*(2.32)*	*(8.51)*	*(8.91)*
# of Observations	505	505	505	505	505	505
# of Countries		77	77		77	77
R-Square	61%			72%		
R-Square, Overall		57%			71%	
Variance Components						
Mean Health Outcome			0.08			0.07
Chi-square			3010.14			3234.33
p-value			0.00			0.00
Level-1 Variance			0.01			0.01

Table 4.
Correlation Matrix for Residuals from Different Regression Procedures.

	OLS	GLS	HLM
Female Adult Mortality Rate			
OLS Regression	1.00		
GLS Regression	0.91	1.00	
Hierarchical Linear Model	0.90	1.00	1.00
Male Adult Mortality Rate			
OLS Regression	1.00		
GLS Regression	0.89	1.00	
Hierarchical Linear Model	0.87	1.00	1.00

Table 5.
Country Performance Rankings on Female Adult Mortality Rate and the Corresponding Residual Values Using OLS regression, GLS regression, and HLM.

	Ranking on Female Mortality			Female Mortality Residuals		
Country Name	OLS	GLS	HLM	OLS	GLS	HLM
ALGERIA	10	13	14	-0.28	-0.27	-0.27
ARGENTINA	29	14	13	-0.05	-0.26	-0.28
BAHRAIN	64	45	41	0.22	0.05	0.04
BANGLADESH	61	67	68	0.19	0.28	0.29
BARBADOS	38	18	16	0.01	-0.21	-0.23
BENIN	55	59	60	0.09	0.20	0.22
BOLIVIA	71	68	67	0.32	0.28	0.28
BOTSWANA	49	49	49	0.06	0.11	0.11
BRAZIL	19	19	20	-0.15	-0.20	-0.21
BULGARIA	51	28	26	0.07	-0.11	-0.13
CAMEROON	67	70	69	0.26	0.34	0.35
CENTRAL AFRICAN RE	45	57	58	0.05	0.19	0.20
CHILE	20	12	12	-0.14	-0.28	-0.30
CHINA	4	9	9	-0.39	-0.32	-0.32
COLOMBIA	25	24	25	-0.08	-0.14	-0.15
COSTA RICA	5	3	2	-0.38	-0.47	-0.48
DOMINICAN REP.	8	10	11	-0.30	-0.31	-0.31
ECUADOR	33	30	29	-0.02	-0.08	-0.09
EGYPT, ARAB REP. OF	16	26	27	-0.19	-0.13	-0.13
EL SALVADOR	14	16	19	-0.21	-0.21	-0.21
FIJI	60	41	40	0.18	0.05	0.03
GAMBIA, THE	65	71	72	0.24	0.37	0.38
GHANA	46	52	53	0.06	0.14	0.15
GUYANA	57	43	43	0.11	0.05	0.05
HAITI	22	35	35	-0.12	-0.02	-0.01
HONDURAS	18	27	28	-0.15	-0.12	-0.12
HUNGARY	62	33	31	0.20	-0.03	-0.05
INDIA	28	39	42	-0.06	0.03	0.04
INDONESIA	59	64	64	0.17	0.22	0.23
IRAN, ISLAMIC REP. O	23	23	23	-0.12	-0.16	-0.16
IRAQ	39	31	33	0.01	-0.04	-0.05
JAMAICA	6	5	5	-0.38	-0.43	-0.43
KENYA	48	55	54	0.06	0.15	0.16
KOREA, REP. OF	66	54	51	0.25	0.15	0.14
LESOTHO	40	48	47	0.03	0.09	0.10
LIBERIA	2	8	8	-0.46	-0.34	-0.33
MALAWI	37	53	55	0.00	0.15	0.16
MALAYSIA	54	38	39	0.09	0.03	0.03
MALI	21	46	46	-0.12	0.06	0.07
MAURITIUS	47	32	32	0.06	-0.04	-0.05
MEXICO	24	20	18	-0.09	-0.20	-0.22

Country Name	Ranking on Female Mortality OLS	GLS	HLM	Female Mortality Residuals OLS	GLS	HLM
MOZAMBIQUE	43	51	52	0.03	0.13	0.14
MYANMAR	13	29	30	-0.25	-0.09	-0.07
NEPAL	50	60	61	0.07	0.21	0.22
NICARAGUA	35	34	34	-0.01	-0.03	-0.03
NIGER	56	66	66	0.10	0.25	0.26
PAKISTAN	30	44	44	-0.05	0.05	0.06
PANAMA	32	25	24	-0.02	-0.14	-0.15
PAPUA NEW GUINEA	74	74	75	0.44	0.47	0.48
PARAGUAY	7	7	7	-0.35	-0.37	-0.38
PERU	70	61	59	0.30	0.21	0.21
PHILIPPINES	76	72	71	0.45	0.38	0.37
POLAND	34	17	15	-0.01	-0.21	-0.24
REUNION	9	11	10	-0.30	-0.31	-0.32
ROMANIA	3	2	3	-0.45	-0.47	-0.48
RWANDA	52	62	63	0.07	0.22	0.23
SENEGAL	75	76	76	0.45	0.50	0.51
SIERRA LEONE	73	77	77	0.43	0.51	0.52
SOUTH AFRICA	77	75	74	0.59	0.48	0.47
SRI LANKA	17	15	17	-0.19	-0.21	-0.22
SUDAN	63	69	70	0.21	0.34	0.35
SWAZILAND	68	65	62	0.27	0.23	0.23
SYRIAN ARAB REP.	41	37	37	0.03	0.00	0.00
TANZANIA	53	63	65	0.08	0.22	0.23
THAILAND	42	36	36	0.03	0.00	-0.01
TOGO	27	47	48	-0.06	0.09	0.11
TRINIDAD AND TOBAG	69	40	38	0.27	0.04	0.02
TUNISIA	15	21	22	-0.21	-0.17	-0.17
TURKEY	1	1	1	-0.84	-0.83	-0.84
UGANDA	44	56	56	0.05	0.18	0.20
URUGUAY	11	4	4	-0.28	-0.45	-0.47
VENEZUELA	36	22	21	0.00	-0.17	-0.18
YEMEN, REP. OF	26	42	45	-0.07	0.05	0.06
YUGOSLAVIA, FED. RE	12	6	6	-0.27	-0.39	-0.40
ZAIRE	31	50	50	-0.03	0.12	0.13
ZAMBIA	72	73	73	0.39	0.44	0.44
ZIMBABWE	58	58	57	0.13	0.19	0.20

Table 6.
Country Performance Rankings on Male Adult Mortality Rate and the Corresponding Residual Values Using OLS regression, GLS regression, and HLM.

Country Name	Ranking on Male Mortality			Male Mortality Residuals		
	OLS	GLS	HLM	OLS	GLS	HLM
ALGERIA	14	15	15	-0.23	-0.24	-0.24
ARGENTINA	43	23	21	0.06	-0.14	-0.16
BAHRAIN	54	32	32	0.14	-0.06	-0.08
BANGLADESH	45	51	50	0.07	0.15	0.16
BARBADOS	26	13	13	-0.09	-0.29	-0.32
BENIN	56	65	66	0.15	0.26	0.27
BOLIVIA	73	67	65	0.32	0.27	0.27
BOTSWANA	34	43	46	-0.01	0.05	0.06
BRAZIL	18	16	16	-0.18	-0.23	-0.24
BULGARIA	60	35	34	0.16	-0.03	-0.05
CAMEROON	69	72	71	0.28	0.35	0.36
CENTRAL AFRICAN RE	61	69	69	0.17	0.30	0.32
CHILE	30	18	17	-0.04	-0.18	-0.20
CHINA	2	7	8	-0.44	-0.38	-0.38
COLOMBIA	23	19	19	-0.12	-0.17	-0.18
COSTA RICA	3	2	2	-0.44	-0.52	-0.53
DOMINICAN REP.	7	9	9	-0.36	-0.36	-0.36
ECUADOR	22	17	18	-0.13	-0.19	-0.20
EGYPT, ARAB REP. OF	20	25	28	-0.15	-0.12	-0.12
EL SALVADOR	38	38	39	0.01	0.01	0.01
FIJI	41	28	27	0.03	-0.10	-0.12
GAMBIA, THE	70	75	76	0.30	0.43	0.45
GHANA	55	60	59	0.15	0.20	0.21
GUYANA	31	33	33	-0.02	-0.05	-0.06
HAITI	28	42	44	-0.06	0.04	0.05
HONDURAS	21	29	31	-0.13	-0.09	-0.09
HUNGARY	68	45	41	0.27	0.06	0.03
INDIA	17	22	22	-0.22	-0.15	-0.14
INDONESIA	52	55	55	0.13	0.18	0.19
IRAN, ISLAMIC REP. O	11	10	11	-0.25	-0.33	-0.34
IRAQ	36	30	29	0.01	-0.09	-0.10
JAMAICA	4	3	3	-0.42	-0.44	-0.45
KENYA	48	58	58	0.11	0.20	0.21
KOREA, REP. OF	72	57	54	0.32	0.19	0.18
LESOTHO	25	40	42	-0.11	0.02	0.03
LIBERIA	10	21	23	-0.26	-0.15	-0.14
MALAWI	39	54	56	0.03	0.18	0.20
MALAYSIA	59	46	45	0.16	0.06	0.05
MALI	29	50	52	-0.05	0.14	0.17
MAURITIUS	58	41	40	0.16	0.03	0.01
MEXICO	32	20	20	-0.02	-0.16	-0.17

Country Name	Ranking on Male Mortality OLS	GLS	HLM	Male Mortality Residuals OLS	GLS	HLM
MOZAMBIQUE	57	64	64	0.16	0.25	0.26
MYANMAR	13	34	36	-0.24	-0.04	-0.02
NEPAL	27	47	47	-0.07	0.07	0.09
NICARAGUA	35	37	37	0.00	-0.01	-0.02
NIGER	51	68	68	0.12	0.28	0.31
PAKISTAN	16	24	25	-0.22	-0.14	-0.13
PANAMA	15	12	12	-0.22	-0.31	-0.33
PAPUA NEW GUINEA	71	70	70	0.32	0.34	0.35
PARAGUAY	5	4	4	-0.40	-0.41	-0.42
PERU	64	49	48	0.21	0.11	0.10
PHILIPPINES	63	52	51	0.20	0.16	0.16
POLAND	65	39	38	0.21	0.02	-0.01
REUNION	24	26	26	-0.11	-0.12	-0.12
ROMANIA	8	6	6	-0.34	-0.38	-0.39
RWANDA	50	66	67	0.12	0.27	0.29
SENEGAL	76	77	77	0.43	0.48	0.49
SIERRA LEONE	74	76	75	0.35	0.43	0.45
SOUTH AFRICA	77	73	72	0.49	0.38	0.37
SRI LANKA	6	8	7	-0.36	-0.37	-0.38
SUDAN	66	71	73	0.22	0.35	0.37
SWAZILAND	67	62	60	0.26	0.22	0.21
SYRIAN ARAB REP.	53	44	43	0.13	0.05	0.05
TANZANIA	46	63	63	0.07	0.23	0.25
THAILAND	37	36	35	0.01	-0.02	-0.02
TOGO	40	56	57	0.03	0.18	0.20
TRINIDAD AND TOBAG	62	31	30	0.17	-0.07	-0.09
TUNISIA	9	14	14	-0.27	-0.26	-0.26
TURKEY	1	1	1	-0.58	-0.61	-0.62
UGANDA	42	59	61	0.06	0.20	0.22
URUGUAY	19	11	10	-0.17	-0.32	-0.35
VENEZUELA	47	27	24	0.08	-0.11	-0.13
YEMEN, REP. OF	33	48	49	-0.01	0.09	0.10
YUGOSLAVIA, FED. RE	12	5	5	-0.24	-0.39	-0.41
ZAIRE	44	61	62	0.07	0.21	0.23
ZAMBIA	75	74	74	0.41	0.43	0.43
ZIMBABWE	49	53	53	0.12	0.17	0.18

Table 7.

Coefficient Estimates of the Effects of Income Per capita, Years of Education, and Technical Progress on Adult Mortality Using Different Model Specifications.

	Male Mortality Rate					Female Mortality Rate				
Coefficient Estimates	1A	2A	3A	4A	5A	1B	2B	3B	4B	5B
Intercept	7.48	7.05	7.19	7.09	7.23	7.51	7.09	7.53	7.09	7.63
logy5	-0.19	-0.14	-0.18	-0.14	-0.17	-0.22	-0.17	-0.25	-0.16	-0.27
	(8.11)	*(6.07)*	*(7.64)*	*(6.06)*	*(7.54)*	*(8.28)*	*(6.48)*	*(9.57)*	*(6.13)*	*(10.19)*
tyrm/tyrf	-0.08	-0.04		-0.04		-0.14	-0.09		-0.09	
	(12.07)	*(5.21)*		*(5.31)*		*(16.50)*	*(9.81)*		*(9.76)*	
logtyrm/logtyrf					-0.13					*-0.04*
					(6.30)					*(2.20)*
year		-0.01					-0.01			
		(8.38)					*(9.13)*			
time1			-0.06	-0.05	-0.05			-0.06	-0.06	-0.05
			(2.90)	*(2.76)*	*(2.44)*			*(2.79)*	*(2.80)*	*(2.39)*
time2			-0.11	-0.09	-0.08			-0.12	-0.09	-0.10
			(5.64)	*(4.71)*	*(4.23)*			*(5.38)*	*(4.33)*	*(4.45)*
time3			-0.14	-0.11	-0.10			-0.17	-0.13	-0.15
			(6.86)	*(5.28)*	*(4.70)*			*(7.46)*	*(5.80)*	*(6.05)*
time4			-0.17	-0.12	-0.11			-0.22	-0.15	-0.19
			(7.91)	*(5.45)*	*(4.81)*			*(8.98)*	*(6.18)*	*(6.92)*
time5			-0.24	-0.17	-0.16			-0.30	-0.20	-0.26
			(10.81)	*(7.19)*	*(6.68)*			*(12.31)*	*(8.12)*	*(9.39)*
time6			-0.29	-0.21	-0.20			-0.37	-0.23	-0.32
			(13.19)	*(8.29)*	*(8.22)*			*(14.87)*	*(8.51)*	*(11.01)*
R-Square, Within	51%	60%	60%	60%	61%	64%	71%	69%	71%	68%
R-Square, Between	62%	61%	51%	61%	62%	74%	73%	55%	73%	62%
R-Square, Overall	59%	57%	47%	57%	58%	71%	71%	53%	71%	59%
Chi-Square	562	702	655	705	734	958	1180	956	1176	933
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 8.
Country Performance Rankings Difference on Female and Male Adult Mortality Rates with GLS, With and Without Education Predicator.

Country Name	Female Mortality Rate			Male Mortality Rate		
	With Edu.	Without Edu.	Difference	With Edu.	Without Edu.	Differenc
ALGERIA	13	27	14	15	21	6
ARGENTINA	14	11	-3	23	18	-5
BAHRAIN	45	55	10	32	40	8
BANGLADESH	67	72	5	51	59	8
BARBADOS	18	6	-12	13	8	-5
BENIN	59	68	9	65	66	1
BOLIVIA	68	48	-20	67	54	-13
BOTSWANA	49	43	-6	43	49	6
BRAZIL	19	22	3	16	20	4
BULGARIA	28	14	-14	35	23	-12
CAMEROON	70	70	0	72	70	-2
CENTRAL AFRICAN REP.	57	63	6	69	68	-1
CHILE	12	10	-2	18	15	-3
CHINA	9	13	4	7	5	-2
COLOMBIA	24	20	-4	19	25	6
COSTA RICA	3	5	2	2	3	1
DOMINICAN REP.	10	17	7	9	13	4
ECUADOR	30	19	-11	17	16	-1
EGYPT, ARAB REP. OF	26	37	11	25	31	6
EL SALVADOR	16	24	8	38	44	6
FIJI	41	23	-18	28	19	-9
GAMBIA, THE	71	74	3	75	77	2
GHANA	52	56	4	60	53	-7
GUYANA	43	26	-17	33	29	-4
HAITI	35	41	6	42	48	6
HONDURAS	27	29	2	29	34	5
HUNGARY	33	12	-21	45	30	-15
INDIA	39	42	3	22	22	0
INDONESIA	64	57	-7	55	52	-3
IRAN, ISLAMIC REP. O	23	39	16	10	14	4
IRAQ	31	50	19	30	36	6
JAMAICA	5	9	4	3	9	6
KENYA	55	54	-1	58	55	-3
KOREA, REP. OF	54	32	-22	57	42	-15
LESOTHO	48	33	-15	40	43	3
LIBERIA	8	21	13	21	32	11
MALAWI	53	47	-6	54	51	-3
MALAYSIA	38	40	2	46	39	-7
MALI	46	52	6	50	62	12
MAURITIUS	32	35	3	41	38	-3
MEXICO	20	18	-2	20	24	4

Country Name	Female Mortality Rate With Edu.	Female Mortality Rate Without Edu.	Female Mortality Rate Difference	Male Mortality Rate With Edu.	Male Mortality Rate Without Edu.	Male Mortality Rate Differenc
MOZAMBIQUE	51	64	13	64	67	3
MYANMAR	29	34	5	34	37	3
NEPAL	60	66	6	47	50	3
NICARAGUA	34	38	4	37	41	4
NIGER	66	69	3	68	72	4
PAKISTAN	44	51	7	24	28	4
PANAMA	25	16	-9	12	11	-1
PAPUA NEW GUINEA	74	76	2	70	73	3
PARAGUAY	7	8	1	4	7	3
PERU	61	44	-17	49	45	-4
PHILIPPINES	72	45	-27	52	47	-5
POLAND	17	4	-13	39	26	-13
REUNION	11	31	20	26	12	-14
ROMANIA	2	1	-1	6	1	-5
RWANDA	62	65	3	66	65	-1
SENEGAL	76	75	-1	77	76	-1
SIERRA LEONE	77	77	0	76	75	-1
SOUTH AFRICA	75	67	-8	73	69	-4
SRI LANKA	15	15	0	8	6	-2
SUDAN	69	73	4	71	74	3
SWAZILAND	65	59	-6	62	63	1
SYRIAN ARAB REP.	37	46	9	44	46	2
TANZANIA	63	49	-14	63	57	-6
THAILAND	36	28	-8	36	35	-1
TOGO	47	53	6	56	61	5
TRINIDAD AND TOBAGO	40	30	-10	31	27	-4
TUNISIA	21	36	15	14	17	3
TURKEY	1	2	1	1	2	1
UGANDA	56	61	5	59	64	5
URUGUAY	4	3	-1	11	10	-1
VENEZUELA	22	25	3	27	33	6
YEMEN, REP. OF	42	62	20	48	58	10
YUGOSLAVIA, FED. REP	6	7	1	5	4	-1
ZAIRE	50	58	8	61	60	-1
ZAMBIA	73	71	-2	74	71	-3
ZIMBABWE	58	60	2	53	56	3

Table 9.
Country Performance Rankings Difference on Female and Male Adult Mortality Rates with GLS and HL

	GLS Ranking			HLM ranking		
Country Name	Female	Male	Difference	Female	Male	Differenc
ALGERIA	13	15	2	14	15	1
ARGENTINA	14	23	9	13	21	8
BAHRAIN	45	32	-13	41	32	-9
BANGLADESH	67	51	-16	68	50	-18
BARBADOS	18	13	-5	16	13	-3
BENIN	59	65	6	60	66	6
BOLIVIA	68	67	-1	67	65	-2
BOTSWANA	49	43	-6	49	46	-3
BRAZIL	19	16	-3	20	16	-4
BULGARIA	28	35	7	26	34	8
CAMEROON	70	72	2	69	71	2
CENTRAL AFRICAN REP.	57	69	12	58	69	11
CHILE	12	18	6	12	17	5
CHINA	9	7	-2	9	8	-1
COLOMBIA	24	19	-5	25	19	-6
COSTA RICA	3	2	-1	2	2	0
DOMINICAN REP.	10	9	-1	11	9	-2
ECUADOR	30	17	-13	29	18	-11
EGYPT, ARAB REP. OF	26	25	-1	27	28	1
EL SALVADOR	16	38	22	19	39	20
FIJI	41	28	-13	40	27	-13
GAMBIA, THE	71	75	4	72	76	4
GHANA	52	60	8	53	59	6
GUYANA	43	33	-10	43	33	-10
HAITI	35	42	7	35	44	9
HONDURAS	27	29	2	28	31	3
HUNGARY	33	45	12	31	41	10
INDIA	39	22	-17	42	22	-20
INDONESIA	64	55	-9	64	55	-9
IRAN, ISLAMIC REP. O	23	10	-13	23	11	-12
IRAQ	31	30	-1	33	29	-4
JAMAICA	5	3	-2	5	3	-2
KENYA	55	58	3	54	58	4
KOREA, REP. OF	54	57	3	51	54	3
LESOTHO	48	40	-8	47	42	-5
LIBERIA	8	21	13	8	23	15
MALAWI	53	54	1	55	56	1
MALAYSIA	38	46	8	39	45	6
MALI	46	50	4	46	52	6
MAURITIUS	32	41	9	32	40	8
MEXICO	20	20	0	18	20	2
MOZAMBIQUE	51	64	13	52	64	12

Country Name	GLS Ranking			HLM ranking		
	Female	Male	Difference	Female	Male	Differenc
MYANMAR	29	34	5	30	36	6
NEPAL	60	47	-13	61	47	-14
NICARAGUA	34	37	3	34	37	3
NIGER	66	68	2	66	68	2
PAKISTAN	44	24	-20	44	25	-19
PANAMA	25	12	-13	24	12	-12
PAPUA NEW GUINEA	74	70	-4	75	70	-5
PARAGUAY	7	4	-3	7	4	-3
PERU	61	49	-12	59	48	-11
PHILIPPINES	72	52	-20	71	51	-20
POLAND	17	39	22	15	38	23
REUNION	11	26	15	10	26	16
ROMANIA	2	6	4	3	6	3
RWANDA	62	66	4	63	67	4
SENEGAL	76	77	1	76	77	1
SIERRA LEONE	77	76	-1	77	75	-2
SOUTH AFRICA	75	73	-2	74	72	-2
SRI LANKA	15	8	-7	17	7	-10
SUDAN	69	71	2	70	73	3
SWAZILAND	65	62	-3	62	60	-2
SYRIAN ARAB REP.	37	44	7	37	43	6
TANZANIA	63	63	0	65	63	-2
THAILAND	36	36	0	36	35	-1
TOGO	47	56	9	48	57	9
TRINIDAD AND TOBAGO	40	31	-9	38	30	-8
TUNISIA	21	14	-7	22	14	-8
TURKEY	1	1	0	1	1	0
UGANDA	56	59	3	56	61	5
URUGUAY	4	11	7	4	10	6
VENEZUELA	22	27	5	21	24	3
YEMEN, REP. OF	42	48	6	45	49	4
YUGOSLAVIA, FED. REP	6	5	-1	6	5	-1
ZAIRE	50	61	11	50	62	12
ZAMBIA	73	74	1	73	74	1
ZIMBABWE	58	53	-5	57	53	-4

Figure 1.
Plots of Country Rankings on Female Mortality Using Different Regression Procedures.

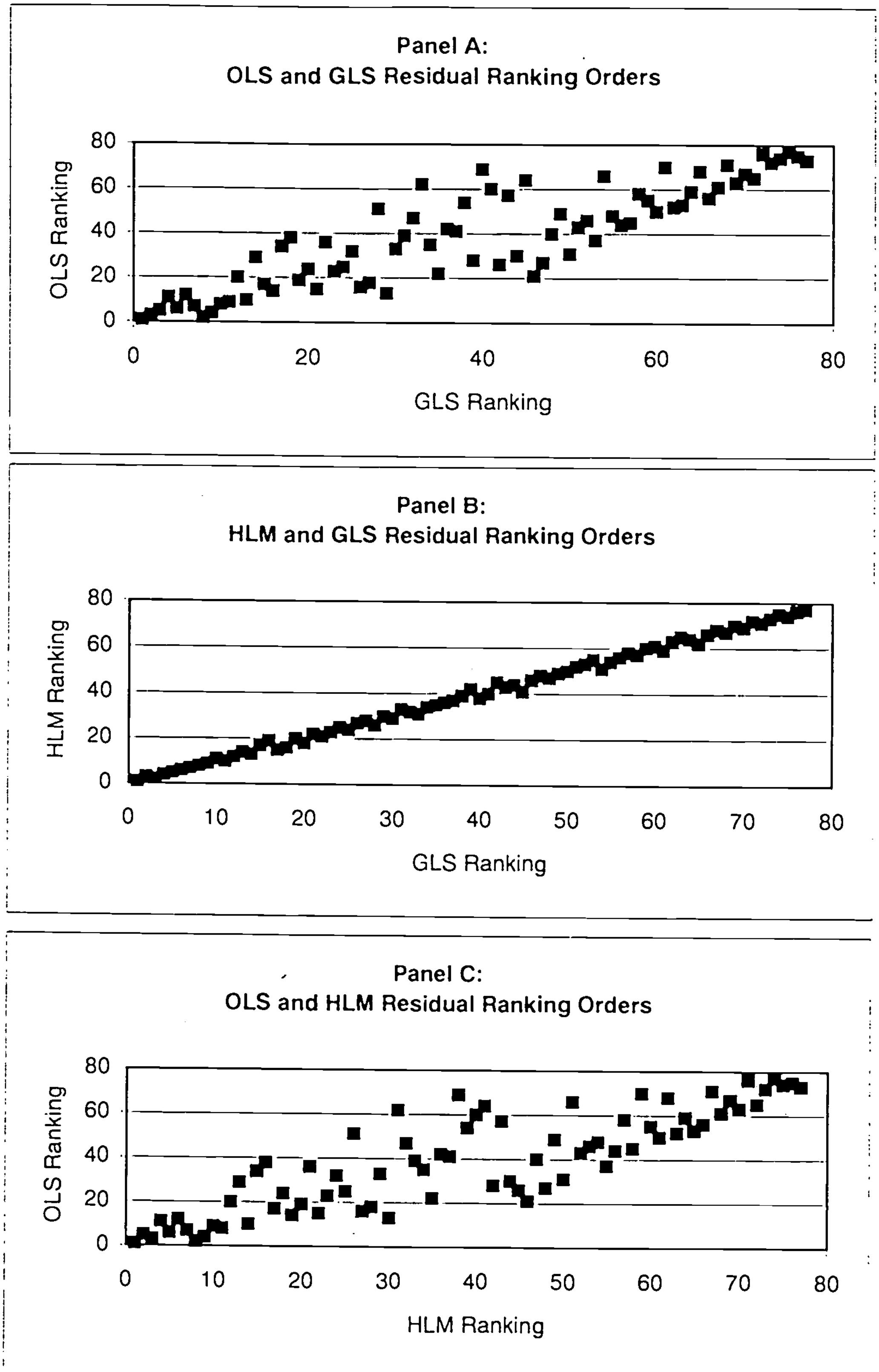


Figure 2.
Plots of Country Rankings on Male Mortality Using Different Regression Procedures.

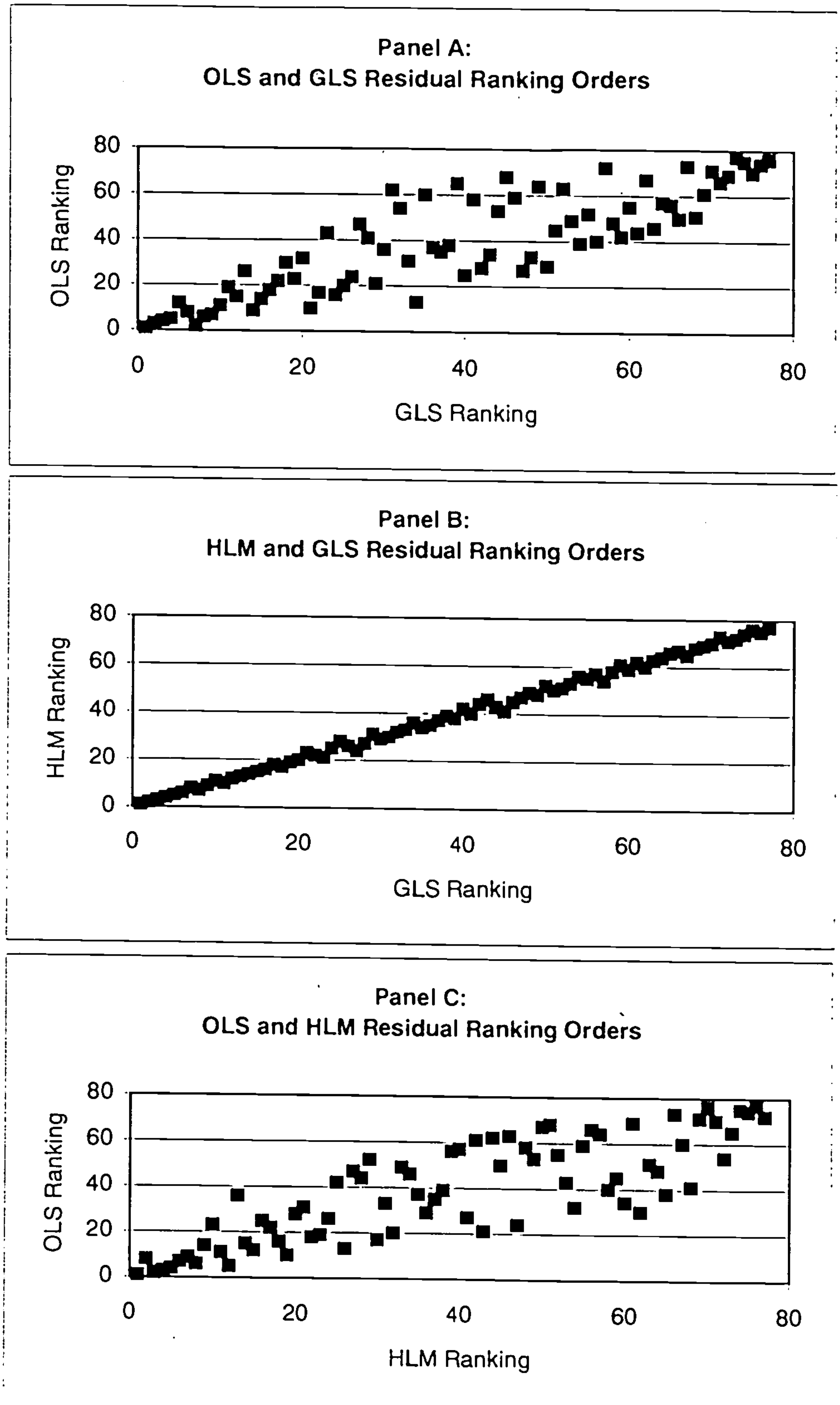


Figure 3.
Country Ranking Difference in Their Performance on Male and Female Adult Mortality Rate From Models With and Without Education Predicator.

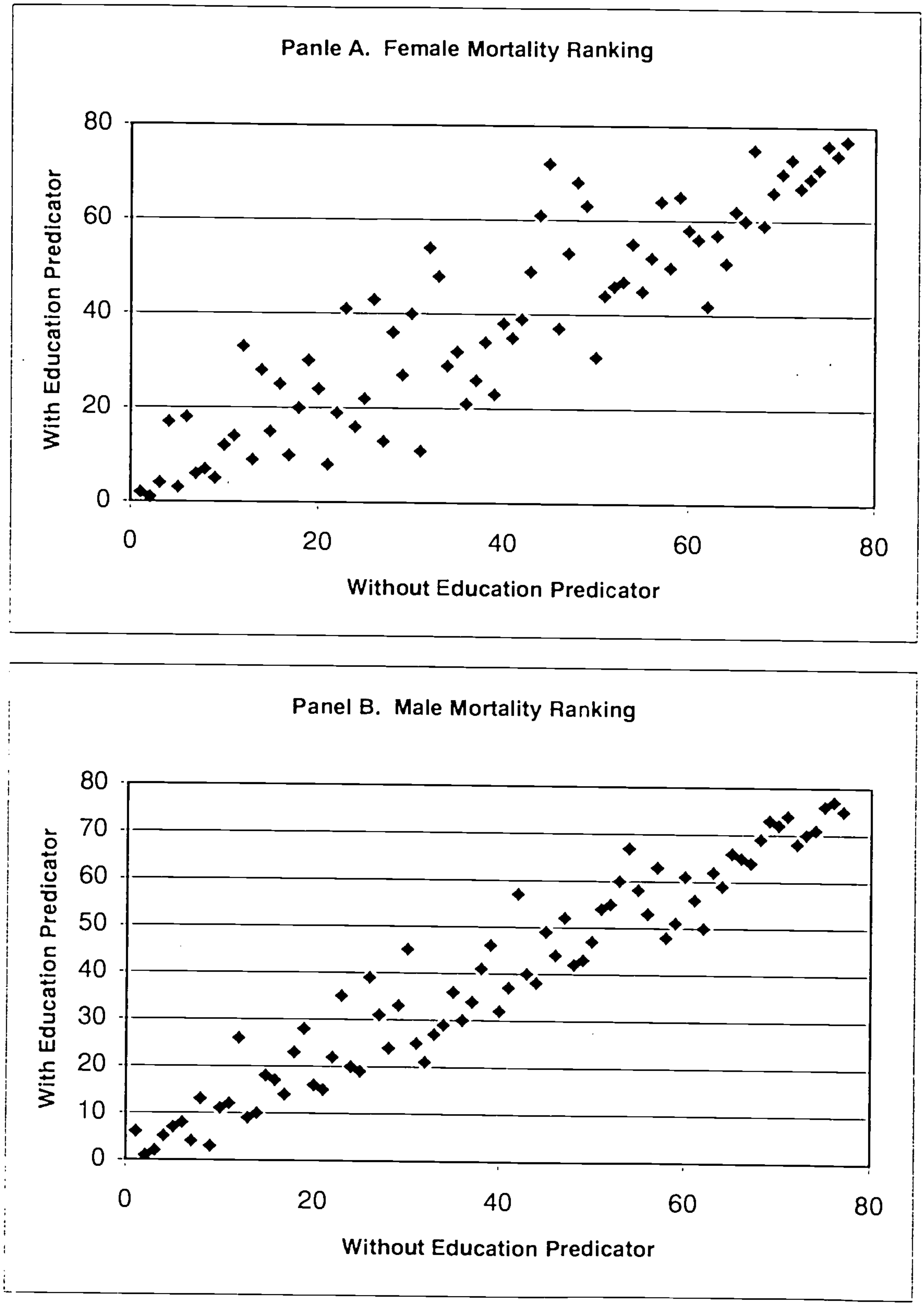
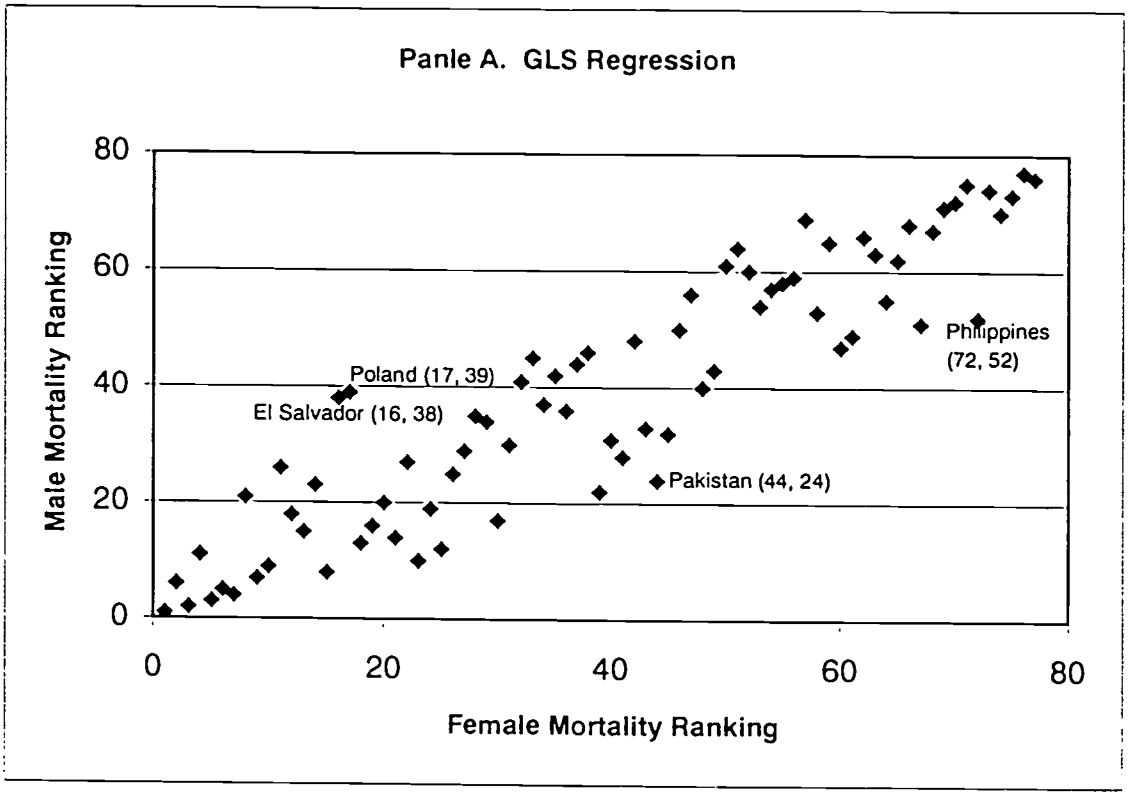
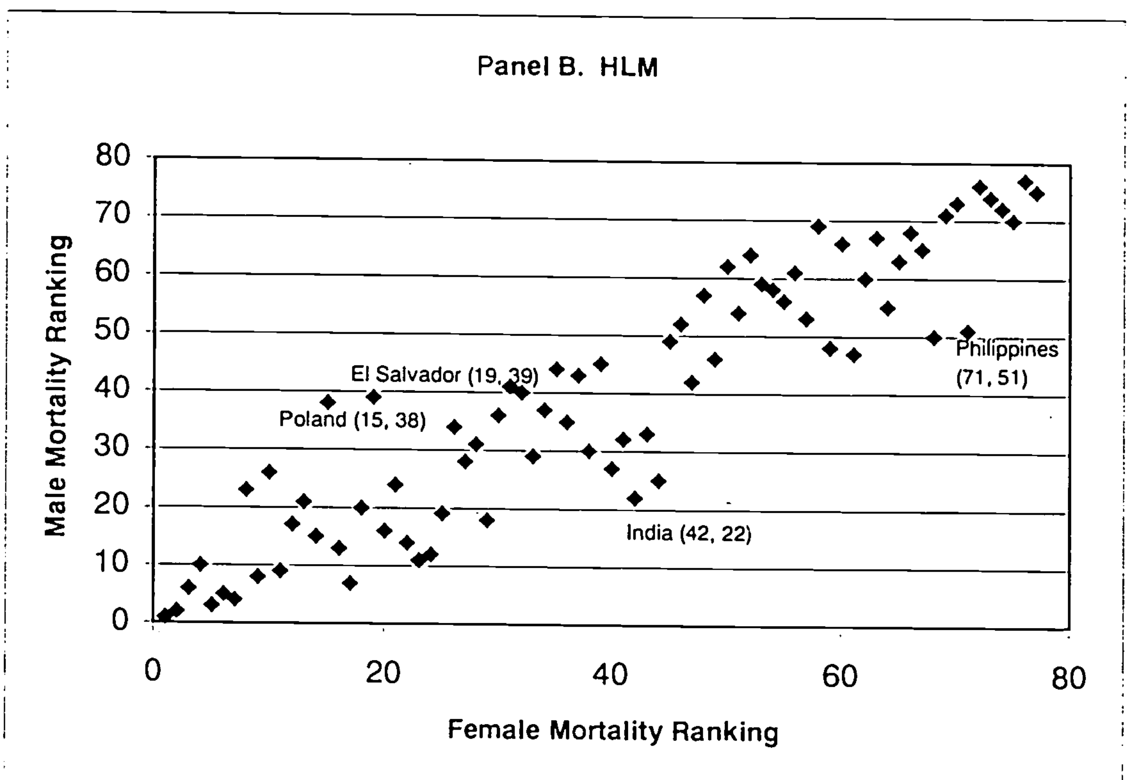


Figure 4.
Country Ranking Difference in Their Performance on Male and Female Adult Mortality Rate





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